GEOTECHNICAL INVESTIGATION
SCHOLES INTERNATIONAL AIRPORT
ROADWAY PAVEMENT IMPROVEMENTS
GALVESTON, TEXAS

REPORT NO. 1140201801

Prepared for:

FREESE AND NICHOLS, INC.

Pearland, Texas

Submitted by:

GEOTEST ENGINEERING, INC.

Houston, Texas

July 24, 2014

Galveston County Key Map No. 807 D

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Report No. 1140201801
July 24, 2014

Mr. Mehran (Ron) Bavarian, P.E.
Freese and Nichols, Inc.
11200 Broadway Street, Suite 2332
Pearland, Texas 77584

Reference: **Geotechnical Investigation and Pavement Design for Scholes International Airport Roadway Pavement Improvements Galveston, Texas**

Dear Mr. Bavarian:

We are pleased to present our final geotechnical investigation report performed for the above referenced project. Preliminary boring logs and pavement recommendations were submitted to you May 27, 2014. Draft report was submitted to you on June 20, 2014. A revised draft report was submitted to you on June 26, 2014. This final report will supersede all previously submitted draft reports, boring logs, transmittals, e-mails, etc. for the referenced project. This study was authorized through Contract for Professional Services dated March 17, 2014 by accepting our Proposal No. 1140342899 dated January 17, 2014.

We appreciate this opportunity to be of service to you. If you have any questions regarding the report, or if we can be of further service to you, please call us.

Very truly yours,
GEOTEST ENGINEERING, INC.
TBPE Registration No. F-410

Naresh Kolli, P.E.
Assistant Project Manager

Mohan Ballagere, P.E.
Vice President

MB\ego
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EXECUTIVE SUMMARY

A geotechnical investigation was conducted by Geotest Engineering, Inc. for the Scholes International Airport Roadway Pavement Improvements in Galveston, Texas.

The project includes approximately 14,400 feet of asphalt roadways, for which 3 repair options have been considered. Repair option 1 involves a Mill and Mix (Recycle Base), as well as localized base repairs in weak base areas. New base to be cement stabilized and then topped with an asphalt overlay. Option 2 involves Milling and Hauling existing asphalt and base, to be replaced with a new cement stabilized base, and then topped with an asphalt overlay. Option 3 involves the seal and overlay on top of existing roadways, with full depth repair in weak base areas. After consideration and evaluation, Option 1 was selected as the Preferred Repair Option for the entire project. The asphalt roadways included are Lockheed Road, Airport Boulevard, Terminal Drive, 83rd Street, Piper Street, and Cessna Drive. The existing roadways will be widened as necessary on both sides of the roadway, to result in a proposed 24-foot section for Lockheed Road and Airport Boulevard, and a proposed 22-foot section for the remaining 4 roadways.

1. The existing paving along the six roadways of the project, as revealed in borings B-1 through B-14, consist of 1.5 to 6.5 inches of asphaltic surface over 4.5 to 16.5 inches of unstabilized base. The unstabilized base consists of limestone, oyster shell, sand and asphaltic material and shell mix.

2. The subgrade beneath the pavement consists of loose to medium dense gray and brown sand, fine sand with silt, silty sand and silty clayey sand. A layer of sandy lean clay was encountered between depths of 2 and 4.5 feet in borings B-3, B-4 and B-12.

3. Groundwater was encountered during drilling at depths ranging from 3.7 to 6 feet in all the borings drilled for this project. The ground water level measured 10 to 15 minutes after the free water was first encountered is at depths ranging from 3.4 to 5 feet in all the borings.

4. The recommended pavement sections for the rehabilitation are given in Section 6.0.

1.0 INTRODUCTION

1.1 Project Description

The project includes asphalt pavement improvements for approximately 14,400 feet of Scholes Airport roadways. After consideration and evaluation of three repair options, the preferred option is the Mill and Mix (Recycled Base), with localized base repairs in weak base areas. New base to be cement stabilized and then topped with an asphalt overlay. The asphalt roadways included are Lockheed Road, Airport Boulevard, Terminal Drive, 83rd Street, Piper Street, and Cessna Drive. The existing roadways will be widened as necessary on both sides of the roadway, to result in a proposed 24-foot section for Lockheed Road and Airport Boulevard, and a proposed 22-foot section for the remaining 4 roadways. The vicinity map is shown on Figure 1.

1.2 Purpose and Scope

The purposes of this investigation were to investigate existing paving and subgrade conditions and to develop geotechnical recommendations of pavement design alternatives for the rehabilitation of existing roadways in Scholes International Airport at Galveston.

The scope of this investigation consisted of the following tasks:

- Asphalt coring at all fourteen (14) boring locations to determine and evaluate the existing paving section.
- Drilling and continuous sampling seven (7) soil borings each to a depth of 10 feet to evaluate subsurface soil conditions.
- Performing laboratory tests on field samples, in accordance with ASTM, to evaluate the physical properties of the existing pavement materials and subsurface soils.
- Performing engineering analyses to evaluate the existing pavement section, and provide recommendations of pavement design alternatives for the rehabilitation of the six existing roadways mentioned above.
- Prepared a geotechnical report summarizing the field, laboratory data and engineering recommendations.

2.0 FIELD INVESTIGATION

Paving and subgrade conditions were investigated by drilling fourteen (14) borings designated as B-1 through B-14 for Scholes International Airport Roadway Pavement Improvements. All borings were drilled with a truck mounted rotary drilling rig. Asphalt coring was performed at all boring locations to evaluate the existing pavement thickness and conduct laboratory tests. The approximate boring locations are shown on Figures 2.1 and 2.2, Plan of Borings.

The soil samples were sampled continuously to a depth of 10 feet, the termination depth of borings. Samples of cohesionless soils and cohesive soils (not retrieved by thin walled tube sampler) were obtained with a 2-inch split barrel sampler in general accordance with ASTM Method D 1586, and samples of cohesive soils were obtained with a 3-inch thin walled tube sampler in general accordance with ASTM D 1587. Each sample was removed from the sampler in the field, carefully examined and logged by an experienced soils technician. Suitable portions of each sample were sealed and packaged for transportation to Geotest's laboratory. The shear strength of cohesive soil samples was estimated using a pocket penetrometer in the field. Driving resistances of the split barrel sampler were recorded in the field as "blows per foot," and are indicated on boring logs. All borings were backfilled with cement-bentonite grout after completion of drilling.

Detailed descriptions of the soils encountered in the borings are given on the boring logs presented on Figures A-1 through A-14 in Appendix A. A key to symbols and terms used on boring logs is given on Figure A-15 in Appendix A.

3.0 LABORATORY TESTING

The laboratory testing program was designed to evaluate the pertinent physical properties and shear strength characteristics of the subsurface soils. Classification tests were performed on selected samples to aid in soil classification. All the tests were performed in accordance with appropriate ASTM standards.

The in-place moisture content (ASTM D 2216) of selected samples was determined to define the moisture profile at each boring location. Liquid limit and plastic limit tests (ASTM D 4318) were performed on selected samples. Results of these tests are summarized on the boring logs.

One (1) laboratory compaction test (ASTM D 698) was performed on composite sample from borings B-1 through B-14 to obtain the maximum dry density and optimum moisture content. One (1) California Bearing Ratio (ASTM D 1883) test was performed on the composite sample from borings B-1 through B-14. The results of laboratory compaction test and CBR tests are presented on Figures B-1 and B-2a through B-2d, respectively in Appendix B.

Specimen of the existing pavement surface course (asphalt) was tested for its asphalt content, gradation, maximum theoretical specific gravity, bulk density and Hveem stability. Particle size analyses of existing pavement base materials were performed to verify its suitability for mix design.

Results of asphalt content, gradation, maximum theoretical density, bulk density and Hveem stability of the top asphaltic surface course are given on Figure B-3 in Appendix B.

Sieve analysis tests were performed on two samples from collected base material. The results of sieve analysis are presented in Figures B-4a and B-4b in Appendix B.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 Existing Paving

Based on the findings from the boring logs, the existing paving along various airport roadways as revealed in borings B-1 through B-14 consist of 1.5 to 6.5 inches of asphaltic surface over 4.5 to 16.5 inches of unstabilized base. The unstabilized base consists of limestone, oyster shell, sand and asphaltic material and shell mix. Details of the existing paving are given below.

Street	Boring No.	Pavement Course	
		Asphalt	Base Course
Terminal Drive	B-1	6.5"	7.0" Oyster Shell and Sand
Terminal Drive	B-2	2.75"	10.5" Oyster Shell and Sand
Terminal Drive	B-3	1.5"	7" Limestone
Piper Street	B-4	1.75"	10" Oyster Shell and Sand
83rd Street	B-5	2.5"	3.0" of Asphalt, and Shell mix
83rd Street	B-6	2.5"	16.5" of Oyster Shell, and Sand
83rd Street	B-7	1.5"	15.5" of Oyster Shell, Gravel and Sand
Airport Blvd.	B-8	2.0"	14.0" Oyster Shell
Airport Blvd.	B-9	2.0"	12.0" Oyster Shell
Lockheed Road	B-10	2.0"	7" Limestone
Lockheed Road	B-11	3.0"	9.0" Oyster Shell
Lockheed Road	B-12	3.0"	4.5" Limestone
Cessna Drive	B-13	1.5"	7.5" Limestone
Cessna Drive	B-14	2.5"	7.0" Oyster Shell

4.2 Subgrade Soils

The subgrade beneath the pavement consists of loose to medium dense gray and brown sand, fine sand with silt, silty sand and silty clayey sand. A layer of sandy lean clay was encountered between the depths of 2 to 4.5 feet in borings B-3, B-4 and B-12.

Sandy Lean Clay is of medium plasticity with liquid limits ranging from 27 to 31 and plasticity indices ranging from 11 to 14. The fines content (passing No. 200 sieve) for Silty Sand and Silty Clayey Sand ranges from 13 to 28 percent. The fines content of Sand and Fine Sand with silt ranges from 2 to 11 percent. The fines content of Sandy Lean Clay ranges from 60 to 70 percent.

4.3 Groundwater

Groundwater was encountered during drilling at depths ranging from 3.7 to 6 feet in all the borings drilled for this project. The groundwater level measured 10 to 15 minutes after the free water was first encountered is at depths ranging from 3.4 to 5 feet in all the borings.

However, it should be noted that various environmental and man-made factors, such as amount of precipitation, nearby subsurface construction activities and changes in area drainage, could substantially influence the groundwater levels.

5.0 ENGINEERING ANALYSES AND RECOMMENDATIONS

5.1 Pavement Recommendations

The project includes approximately 14,400 feet of asphalt roadways, for which 3 repair options have been considered. Repair option 1 involves a Mill and Mix (Recycled Base), as well as localized base repairs in weak base areas. New base to be cement stabilized and then topped with an asphalt overlay. Option 2 involves Milling and Hauling existing asphalt and base, to be replaced with a new cement stabilized base, and then topped with an asphalt overlay. Option 3 involves the seal and overlay on top of existing roadways, with full depth repair in weak base areas. After consideration and evaluation, Option 1 was selected as the Preferred Option for the entire project. The asphalt roadways included are Lockheed Rd., Airport Blvd., Terminal Dr., 83rd St., Piper St., and Cessna Dr. The existing roadways will be widened as necessary on both sides of the roadway, to result in a proposed 24-foot section for Lockheed Rd. and Airport Blvd., and a proposed 22-foot section for the remaining 4 roadways.

Based on our understanding, rehabilitation of existing pavement is considered for the project. The rehabilitation method includes the recycling of existing pavement material (shell and asphalt), adding stabilization to be used as base material, and then topped with asphalt overlay. However, the reclaimed material (predominantly oyster shell, encountered along the six roadways of the project) may possess poorly graded material as shown in the sieve analysis report (Figure B-4a). Therefore, the recycled base will not provide sufficient bonding and strength as required for the base course unless coarse aggregate are added to the mixture. Hence, an alternative rehabilitation method was considered. The alternative rehabilitation method includes milling, adding coarse crushed concrete base, mixing the existing asphalt, the shell base, and the crushed concrete with portland cement, creating a new recycled base to be overlayed with new asphalt surface course. The pavement design and the construction of the alternative rehabilitation method is discussed below.

5.2 Pavement Design Method

The pavement design was developed in accordance with the "AASHTO Guide for Design of Pavement Structures" 1993 edition.

5.3 Design Parameters

Subgrade Soil Properties. Based on the laboratory test data obtained from the natural subgrade soils, the effective roadbed resilient modulus (M_R) is estimated to be 16,603 psi.

Traffic Data. No traffic counts were available for this study, however, a traffic data of 0.24 x 10^6 - 18 kips ESAL (W_{18}) over a 20 year design period was used for the design. This traffic data was based on 200 vehicles per day with 1% truck traffic.

Other Design Parameters. Other design parameters used in the development of flexible pavement structural number are given below:

- Flexible Pavement: Overall Standard Deviation (S_o): 0.45
  Reliability Level (R): 80%
  Serviceability Index
  Initial (P_o): 4.2
  Terminal (P_t): 2.0

  Layer, coefficient:
  a_1, a_2, a_3 = layer coefficient for surface, base and subbase course, respectively. Values of the layer coefficient for each pavement material are as follows:

  a_1 = 0.44 for HMHL asphalt concrete surface
  a_2 = 0.34 for Asphalt concrete black base

= 0.23 for Cement stabilized base

= 0.17 for lime and flyash stabilized base

a_3 = 0.11 for Lime stabilized soils

Drainage coefficient:

m_2, m_3 = Drainage coefficient for base and subbase layers; m_2 = 1.15 and m_3 = 1.15 (based on a fair quality of drainage)

5.4 Recommended Pavement Section

Based on the design parameters described above and on AASHTO design procedures, the structural number for flexible pavement was determined. The recommended pavement sections are given below.

Pavement Course	**Thickness (inches)**
Asphaltic Concrete Surface	2.0
Geotextile Fabric Mat	--
Cement Stabilized recycled asphalt, shell base with crushed concrete	8.0

5.5 Pavement Construction

The proposed pavement section given above can be constructed in accordance with guidelines given below:

- Mill the existing asphalt surface (depth varies) and existing base material (approximately 4" depth).
- Spread the milled material to entire width of the pavement including the widening of both sides of the existing pavement. After spreading, the milled material thickness should be around 4 inches through the entire pavement width.
- Add an additional 4" of coarse crushed concrete on top of milled and spread material for entire width including the widened section, then add 8% - 10% portland cement (depending on

gradation). This cement stabilized crushed concrete and recycled asphalt and shell mix should be compacted and cured to an approximate depth of 8 inches in accordance with TxDOT Specification Item No. 275.

- Place a geofabric mat over the compacted stabilized recycled base material.
- Finally, place the 2 inch asphaltic concrete surface in accordance with TxDOT Specification Item 340.

Further, at location near boring B-5 where existing pavement thickness is 5.5 inches, after milling about 4 inches; over excavation and replacing with additional crushed concrete thickness will be required for the recycled 8-inch base.

Please note that in areas where significant base failures were noticed, spot base repair is recommended.

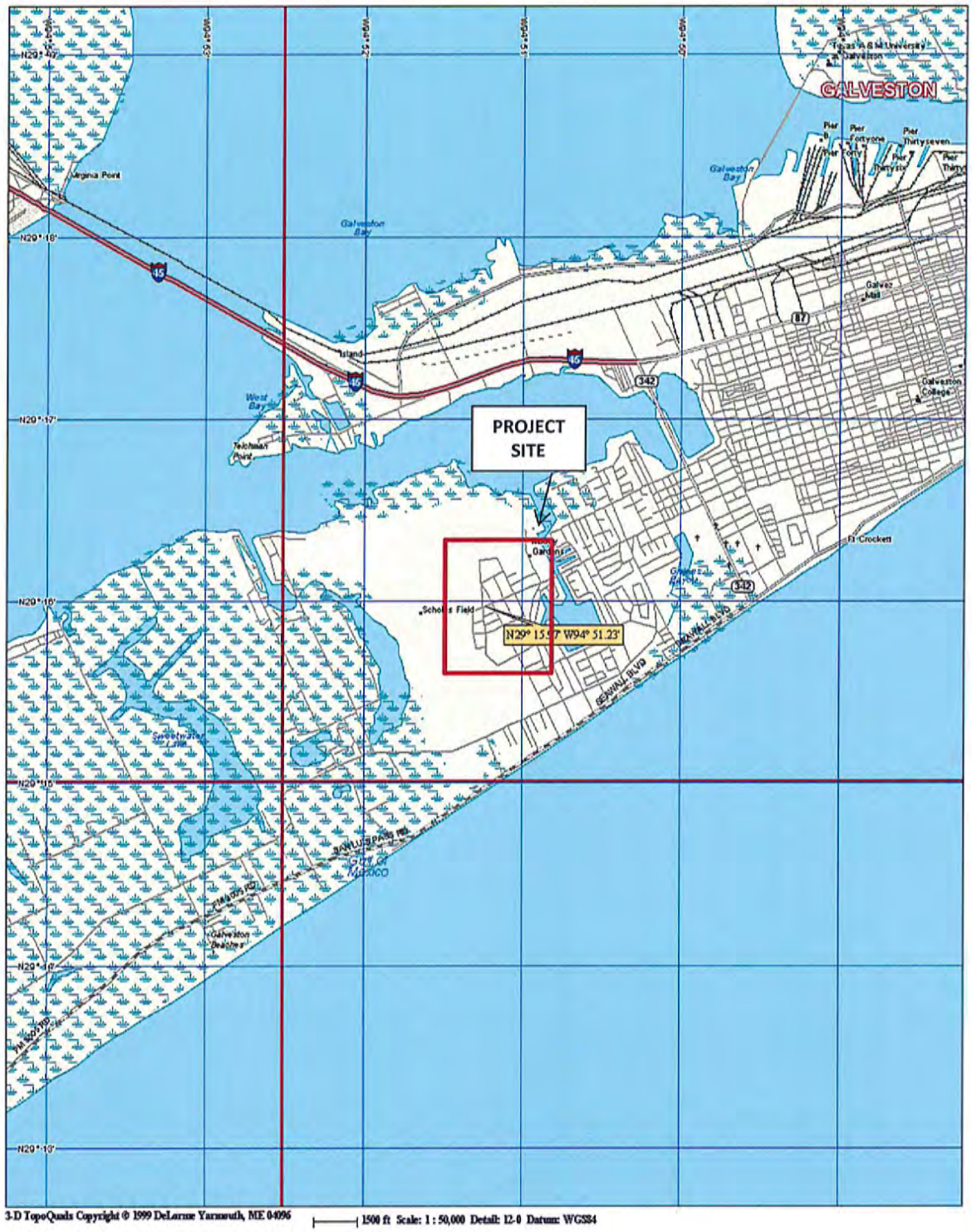
6.0 PROVISIONS

The description of subsurface conditions and the design information contained in this report are based on borings made at specific locations. However, some variation in soil conditions may occur between test locations. Should any subsurface conditions other than those described in our boring logs be encountered, Geotest should be immediately notified so that further investigation and supplemental recommendations can be provided. The depth of the groundwater level may vary with changes in environmental conditions such as frequency and magnitude of rainfall. The stratification lines on the log of borings represent the approximate boundaries between soil types, however, the transition between soil types may be more gradual than depicted.

This report has been prepared for the exclusive use of Freese and Nichols, Inc., and the Scholes International Airport Roadway Pavement Improvements in Galveston, Texas.

ILLUSTRATIONS

Job No. 1140201801



Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

VICINITY MAP

Geotest Engineering, Inc.

FIGURE 1

Job No. 1140201801

N

0 50' 100' 200'
SCALE IN FEET

CESSNA DRIVE

0+00

5+00

STA 9+00.00, 7.00' LT
Terminal Dr
Northing: 13668831.12
Easting: 3290273.76

Latitude: N29° 16' 08.88"
Longitude: W94° 51' 11.22"

Exist Ground El. 5.49

B-1

B-13

STA 7+00.00, 7.00' LT
Cessna Dr

Northing: 13668556.04
Easting: 3290445.69

Latitude: N29° 16' 06.10"
Longitude: W94° 51' 09.39"

Exist Ground El. 5.32

10+00

TERMINAL DRIVE

15+00

B-2

STA 17+00.00, 7.00' LT
Terminal Dr
Northing: 13669630.66
Easting: 3290243.15

Latitude: N29° 16' 16.80"
Longitude: W94° 51' 11.24"

Exist Ground El. 5.10

20+00

STA 3+50.00, 8.00' RT
Airport Blvd

Northing: 13669517.98
Easting: 3290520.64

Latitude: N29° 16' 15.59"
Longitude: W94° 51' 08.16"

Exist Ground El. 5.76

AIRPORT BLVD

STA 4+00.00, 7.00' LT
83rd St

Northing: 13668629.02
Easting: 3291212.59

Latitude: N29° 16' 06.55"
Longitude: W94° 51' 00.70"

Exist Ground El. 5.19

B-5

83RD STREET

B-6

B-7

STA 17+50.00, 6.00' RT
83rd St

Northing: 13669837.86
Easting: 3290611.40

Latitude: N29° 16' 18.72"
Longitude: W94° 51' 07.00"

Exist Ground El. 4.90

STA 24+50.00, 28.00' LT
83rd St

Northing: 13670445.12
Easting: 3290260.47

Latitude: N29° 16' 24.86"
Longitude: W94° 51' 10.72"

Exist Ground El. 4.88

Legend:

Boring

MATCH LINE SEE SHEET 6

MATCH LINE SEE SHEET 6

PLAN OF BORINGS

FIGURE 2.1

MK.	DESCRIPTION	DATE	DWN.	CHK.

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CITY OF GALVESTON 1839

SCHOLES INTERNATIONAL AIRPORT

PROJECT LAYOUT

Project No.: GAV14171	Scale: HORZ: 1" = 20' VERT: 1" = 2'	SHEET 5 OF 38
Date: JAN, 2014		
Dwn By: Rick Lane		
Chkd By: Ron Bavarian		

ACAD Rel 19.0s (LMS Tech) User: 02178
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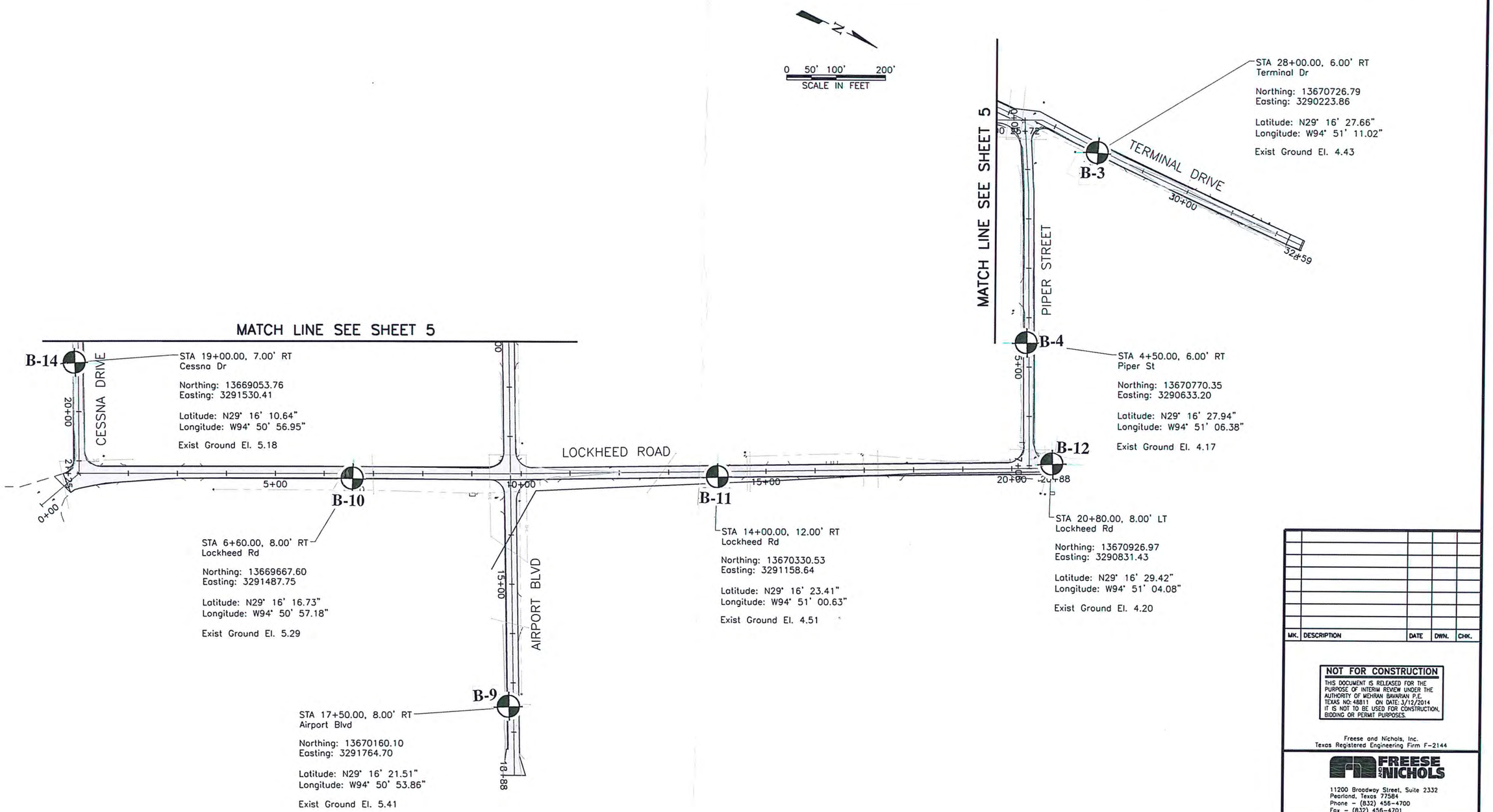
Date: Mar 28, 2014 - 8:03am User: 02178 File: N:\IF\Drawings\Project Layout\CV-ALL-PLO-GEOTECH.dwg

Job No. 1140201801



Legend:

Boring

PLAN OF BORINGS

FIGURE 2.2

MK.	DESCRIPTION	DATE	DWN.	CHK.

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CITY OF GALVESTON 1839

SCHOLES INTERNATIONAL AIRPORT

PROJECT LAYOUT

Project No.: GAV14171	Scale: HORZ: 1" = 20' VERT: 1" = 2'	SHEET 9 OF 38
Date: JAN, 2014		
Dwn By: Rick Lane		
Chkd By: Ron Bavarian		

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Date: Mar 28, 2014 - 8:03am User: 02178 File: N:\IF\Drawings\Project Layout\CV-ALL-PLO-GEOTECH.dwg

APPENDIX A

LOG OF BORING NO. B-1

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : Terminal Drive
See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 5.5 FT.
WET ROTARY : 5.5 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			6.5" Asphalt over 7" Oyster Shell and Sand				18			
				Medium dense to dense gray and brown FINE SAND (SP-SM) w/silt -w/clay seams 13.5"-2'	30	11		22			
	5				21			25			
					28			27			
	10				37			25			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.5 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-1

LOG OF BORING NO. B-2

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : Terminal Drive
See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 5.0 FT.
WET ROTARY : 5.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			2.75" Asphalt over 10.5" Oyster Shell and Sand							
				Dense brown SILTY SAND (SM) -w/clay seams 2'-4' -gray 2.5'-4'	42	16		19			
	5			-medium dense gray and brown 4.5'-6'	24			24			
				Dense gray SAND (SP)	39	3		23			
				-w/shell 8.5'-10'							
	10				37			24			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER ENCOUNTERED AT 5.0 FT. DURING DRILLING.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-2

LOG OF BORING NO. B-3

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : Terminal Drive
See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 6.0 FT.
WET ROTARY : 6.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			1.5" Asphalt over 7" Limestone				14			
				Brown SAND (SP)							
				Gray SANDY LEAN CLAY (CL)	14	60		21	27	16	11
	5			Medium dense gray SAND (SP)	28			23			
				-dense 6.5'-10'	36	2		24			
	10				43			24			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-3

LOG OF BORING NO. B-4

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : Piper Street
See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 6.0 FT.
WET ROTARY : 6.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			1.75" Asphalt over 10" Oyster Shell and Sand				14			
				Gray SAND (SP) w/clay seams							
				Stiff to very stiff gray SANDY LEAN CLAY (CL)		70		24	31	17	14
	5			Medium dense gray FINE SAND (SP-SM) w/silt	19	5		23			
				-dense 6.5'-10'	31			25			
	10				39			21			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

△ at 1.0 ○ at 1.0

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-4

LOG OF BORING NO. B-5

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : 83rd Street
See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 6.0 FT.
WET ROTARY : 6.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			2.5" Asphalt over 3" Ashpalt and Shell Mix				12			
				Medium dense brown and gray FINE SAND (SP-SM) w/silt	20	5		19			
	5			Medium dense brown and gray SAND (SP)	15			25			
					19	3		27			
				-gray 8.5'-10'							
	10				28			25			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-5

LOG OF BORING NO. B-6

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : 83rd Street
See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 6.0 FT.
WET ROTARY : 6.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			2.5" Asphalt over 16.5" Oyster Shell and Sand				15			
				Gray SAND (SP) -dense 2.5'-6'	38			16			
	5			-gray and yellow 4.5'-6'	38	4		24			
				-medium dense 6.5'-8'	23			24			
	10				37			24			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-6

LOG OF BORING NO. B-7

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : 83rd Street
See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 6.0 FT.
WET ROTARY : 6.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			1.5" Asphalt over 15.5" Oyster Shell, Gravel and Sand				19			
	5			Medium dense gray SILTY SAND (SM)	18	13		19			
					15			25			
				Medium dense gray SAND (SP)							
					14	2		25			
				-loose 8.5'-10'							
	10				8			25			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-7

LOG OF BORING NO. B-8

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : Airport Blvd
See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 6.0 FT.
WET ROTARY : 6.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			2" Asphalt over 14" Oyster Shell				14			
				Medium dense brown and gray FINE SAND (SP-SM) w/silt	14	6		21			
	5			-gray 2.5'-4'	22	5		25			
					23			26			
	10				27			24			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-8

LOG OF BORING NO. B-9

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : Airport Blvd
See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 8.0 FT.
WET ROTARY : 8.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			2" Asphalt over 12" Oyster Shell				15			
				Medium dense brown and gray FINE SAND (SP-SM) w/silt	24	8		21			
	5				24	5		24			
					22			25			
				-gray 8.5'-10'							
	10				27			24			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 6.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 5.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-9

LOG OF BORING NO. B-10

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : Lockheed Road
See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 6.0 FT.
WET ROTARY : 6.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			2" Asphalt over 7" Limestone							
				Medium dense gray SILTY SAND (SM) w/shell mix	22	28		8 18			
	5			Medium dense to dense gray SAND (SP)	18 35			22 26			
	10				36			24			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-10

LOG OF BORING NO. B-11

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : Lockheed Road
See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 6.0 FT.
WET ROTARY : 6.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			3" Asphalt over 9" Oyster Shell and Sand				14			
				Brown and gray SAND (SP)		38		14	21	14	7
				Gray and brown SILTY CLAYEY SAND (SC-SM)	18	17		20			
	5			Medium dense gray SILTY SAND (SM) -dense 4.5'-6'	32			24			
					24			24			
	10				28			23			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-11

LOG OF BORING NO. B-12

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : Lockheed Road
See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 6.0 FT.
WET ROTARY : 6.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			3" Asphalt over 4.5" Limestone				15			
				Gray SAND (SP)							
				Stiff gray SANDY LEAN CLAY (CL)		57		20	30	15	15
	5			Medium dense gray FINE SAND (SP-SM) w/silt	18	7		26			
					21			24			
				-dense 8.5'-10'							
	10				35			21			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

△ (1.0)

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-12

LOG OF BORING NO. B-13

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

LOCATION : Cessna Drive
See Plan of Borings (Figure 2.1)

SURFACE ELEVATION : Existing Grade

PROJECT NO. : 1140201801

COMPLETION DEPTH : 10.0 FT.

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon

DRY AUGER : 0.0 TO 4.0 FT.

WET ROTARY : 4.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			1.5" Asphalt over 7.5" Limestone	39			17			
				Dense brown SILTY SAND (SM) -w/shell fragments 1'-2' -very dense brown and gray 2.5'-4'	55	13		23			
	5			-medium dense 4.5'-8' -gray 4.5'-10'	11			27			
					11			26			
				-loose 8.5'-10'	8			27			
	10										
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF

- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 3.7 FT. DURING DRILLING; AFTER 15.0 MIN. AT 3.4 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-13

LOG OF BORING NO. B-14

PROJECT : Scholes International Airport
Roadway Pavement Improvements
Galveston, Texas

PROJECT NO. : 1140201801

LOCATION : Cessna Drive
See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : Existing Grade

DATE : 04-06-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 6.0 FT.
WET ROTARY : 6.0 TO 10.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			2.5" Asphalt over 7" Oyster Shell and Sand							
				Medium dense brown FINE SAND (SP-SM) w/silt				16			
					17	5		22			
	5				13			24			
				-gray 6.5'-10'							
					19			25			
	10				25			26			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 5.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 4.0 FT.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

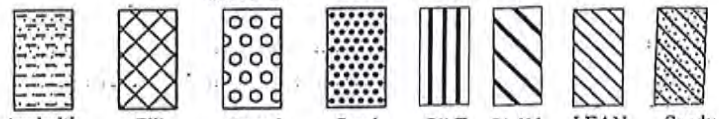
Geotest Engineering, Inc.

FIGURE A-14

Job No. 1140201801

SYMBOLS AND TERMS USED ON BORING LOGS

SOIL TYPES
(SHOWN IN SYMBOL COLUMN)



Asphaltic Concrete | Fill | Gravel | Sand | SILT . CLAY | LEAN CLAY | Sandy LEAN CLAY

Predominant type shown heavy

SAMPLER TYPES
(SHOWN IN SAMPLES COLUMN)

Pitcher Barrel | Nx Core | Shelby Tube | Piston | Split Spoon | No Recovery | Auger

TERMS DESCRIBING CONSISTENCY OR CONDITION

Basic Soil Type	Density or Consistency	Standard Penetration Resistance, [1] Blows/ft.	Unconfined Compressive Strength (q_u), [2] Tons/sq. ft.
Cohesionless	Very loose	Less than 4	Not applicable
	Loose	4 to <10	Not applicable
	Medium dense	10 to <30	Not applicable
	Dense	30 to <50	Not applicable
	Very dense	50 or greater	Not applicable
Cohesive	Very soft	Less than 2	Less than 0.25
	Soft	2 to <4	0.25 to <0.5
	Firm/Medium stiff	4 to <8	0.5 to <1.0
	Stiff	8 to <15	1.0 to <2.0
	Very stiff	15 to <30	2.0 to <4.0
	Hard	30 or greater	4 or greater

(1) Number of blows from 140-lb. weight falling 30-in. to drive 2-in. OD, 1-3/8-in. ID, split barrel sampler (ASTM D1586)

(2) q_u may also be approximated using a pocket penetrometer

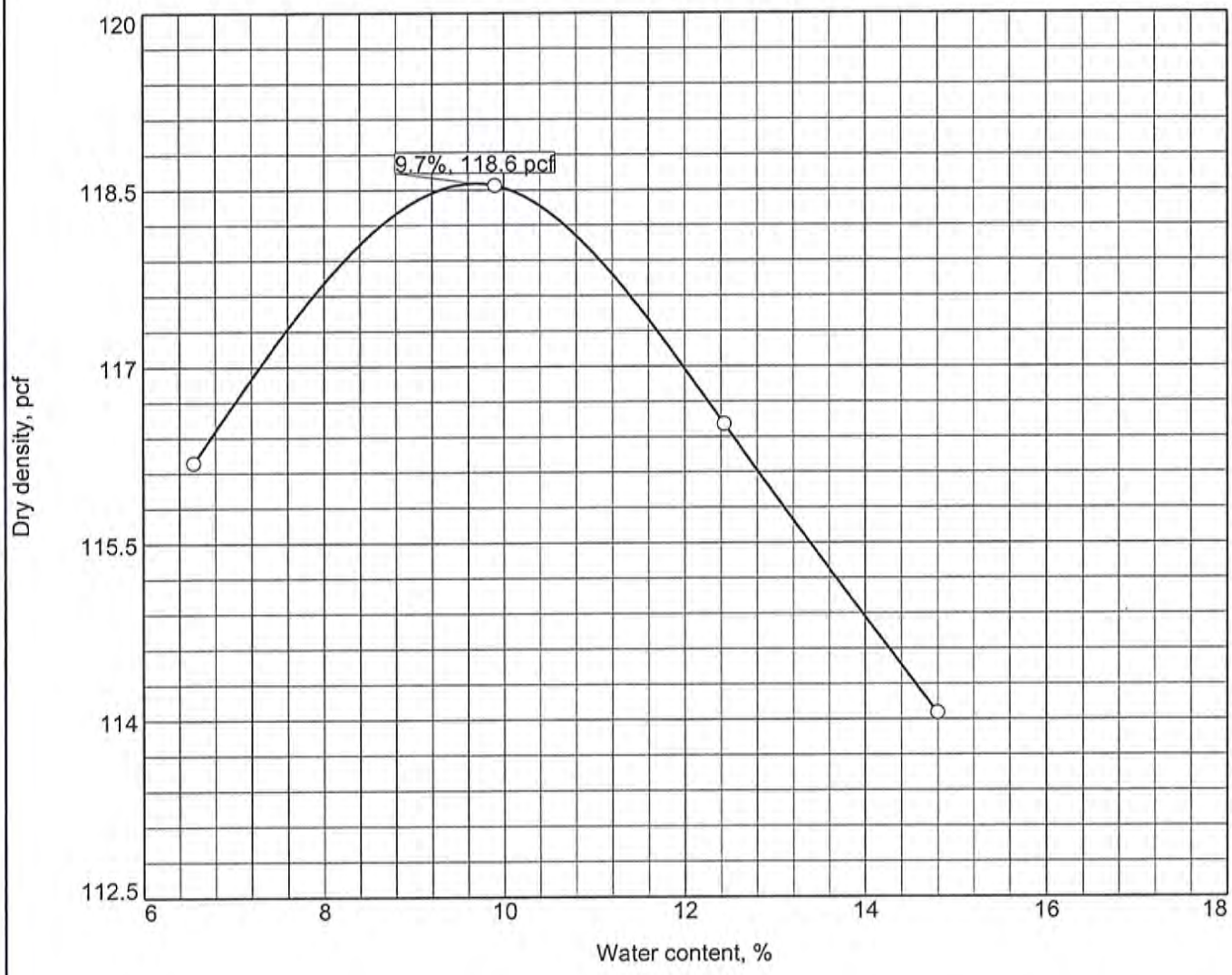
TERMS CHARACTERIZING SOIL STRUCTURE

Parting: -paper thin in size Seam: -1/8" to 3" thick Layer: -greater than 3"

Slickensided	- having inclined planes of weakness that are slick and glossy in appearance.
Fissured	- containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated	- composed of thin layers of varying color and texture.
Interbedded	- composed of alternate layers of different soil types.
Calcareous	- containing appreciable quantities of calcium carbonate.
Well graded	- having wide range in grain sizes and substantial amounts of all intermediate particle sizes.
Poorly graded	- predominantly of one grain size, or having a range of sizes with some intermediate size missing.
Flocculated	- pertaining to cohesive soils that exhibit a loose knit or flakey structure.

APPENDIX B

COMPACTION TEST REPORT



Test specification: ASTM D698-12 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
	SM	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 118.6 pcf Optimum moisture = 9.7 %	Brown and Gray Silty Sand
Project No. 1140201801 **Client:** Freese and Nichols, Inc. **Project:** Scholes International Airport Roadway Pavement Improvements ○ **Sample Number:** 2	**Remarks:**
GEOTEST ENGINEERING, INC. **Houston, TX**	

FIGURE B-1

Tested By: K. Patel **Checked By:** A. Ary

CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

ASTM D1883

Project: Scholes International Airport Roadway Pavement Improvements **Job No.:** 1140201801

Sample Location: Composite sample from borings GB-1 through GB-14 (0'-6')

Sample Description: Brown and gray Silty Sand

Liquid Limit: NP **Plastic Limit:** NP **Plasticity Index:** NP

Method of Compaction: ☒ ASTM D698
☐ ASTM D1557

Blows per layer: 10

Sample Condition: ☒ soaked ☐ unsoaked

Dry Density before soaking 97.2 pcf

Dry Density after soaking 97.2 pcf

Moisture Content:

Before compaction	15.8 %
After compaction	15.6 %
Top 1-in layer after soaking	21.3 %
Average after soaking	20.2 %

Swell 0.0 %

Bearing Ratio 9.68 % (☒ soaked ☐ unsoaked)

Surcharge 10 lbs

CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

ASTM D1883

Project: Scholes International Airport Roadway Pavement Improvements **Job No.:** 1140201801

Sample Location: Composite sample from borings GB-1 through GB-14 (0'-6')

Sample Description: Brown and gray Silty Sand

Liquid Limit: NP **Plastic Limit:** NP **Plasticity Index:** NP

Method of Compaction: ☒ ASTM D698
☐ ASTM D1557

Blows per layer: 25

Sample Condition: ☒ soaked ☐ unsoaked

Dry Density before soaking 101.2 pcf

Dry Density after soaking 101.2 pcf

Moisture Content:

Before compaction	15.8 %
After compaction	15.8 %
Top 1-in layer after soaking	18.5 %
Average after soaking	18.0 %

Swell 0.0 %

Bearing Ratio 22.76 % (☒ soaked ☐ unsoaked)

Surcharge 10 lbs

CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

ASTM D1883

Project: Scholes International Airport Roadway Pavement Improvements **Job No.:** 1140201801

Sample Location: Composite sample from borings GB-1 through GB-14 (0'-6')

Sample Description: Brown and gray Silty Sand

Liquid Limit: NP **Plastic Limit:** NP **Plasticity Index:** NP

Method of Compaction: ☒ ASTM D698
☐ ASTM D1557

Blows per layer: 56

Sample Condition: ☒ soaked ☐ unsoaked

Dry Density before soaking 103.3 pcf

Dry Density after soaking 103.3 pcf

Moisture Content:

Before compaction	15.8 %
After compaction	15.8 %
Top 1-in layer after soaking	18.5 %
Average after soaking	17.6 %

Swell 0.0 %

Bearing Ratio 24.96 % (☒ soaked ☐ unsoaked)

Surcharge 10 lbs

Job No. 1140201801

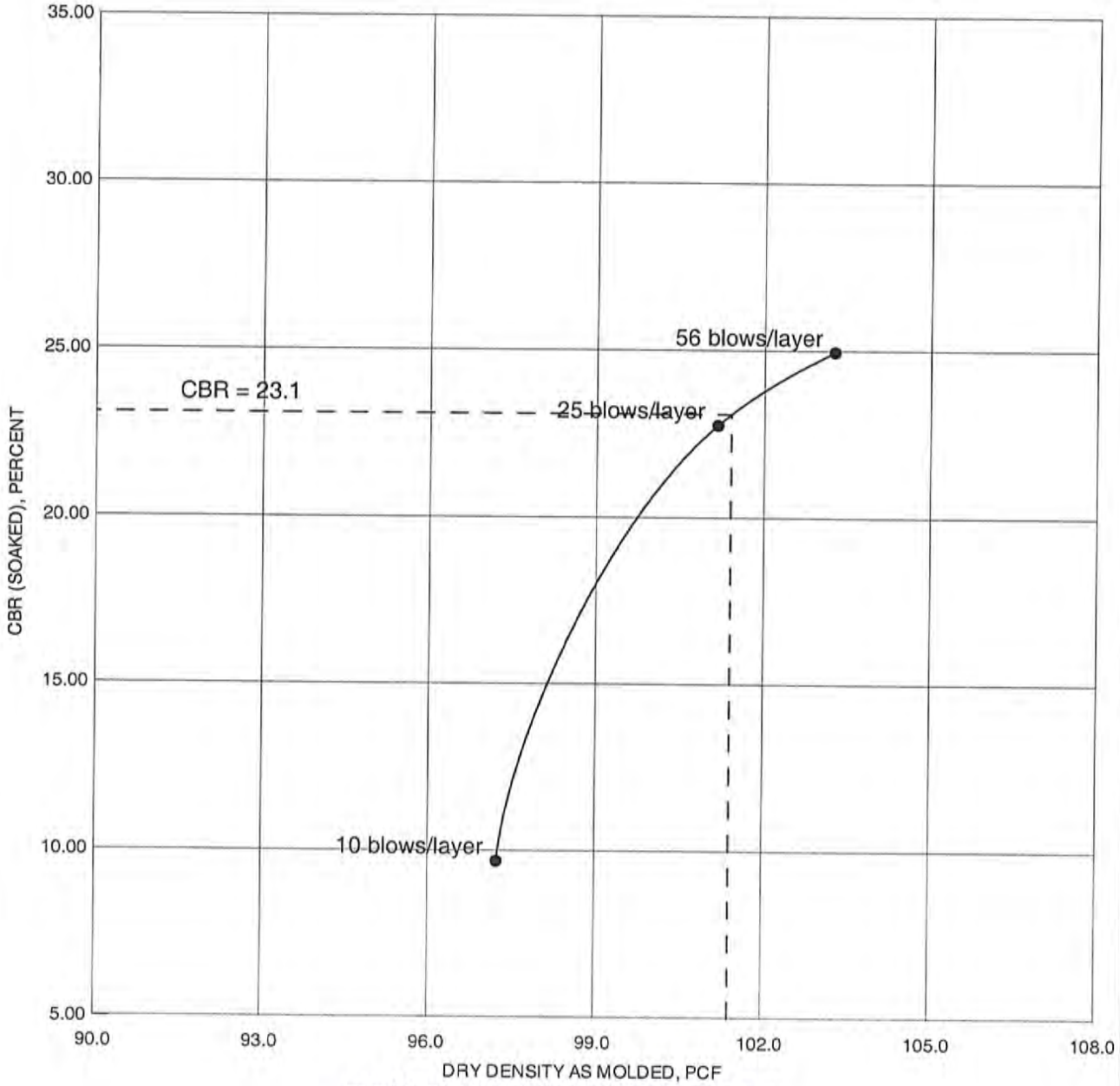
Project: Scholes International Airport Roadway Pavement Improvements

Sample Location: Composite sample from borings GB-1 through GB-14 (0'-6')

Sample Description: Brown and gray Silty Sand

Liquid Limit: NP **Plastic Limit:** NP **Plasticity Index:** NP

Dry Density (pcf): 101.4



DRY DENSITY VERSUS CBR
(ASTM D 1883)

Geotest Engineering, Inc.

FIGURE B-2d

GEOTEST ENGINEERING, INC.
5600 Bintliff Drive Houston, Texas 77036 Tel. (713) 266-0588

REPORT OF ASPHALT CONCRETE MIXTURE TEST RESULTS

(TXDOT, 201F, 206F, 207F, 208F, 210F)

Project: Scholes International Airport Roadway Pavement Improvements Galveston, Texas — Job No: 1140201801

Client: Freese and Nichols, Inc.

ASPHALT CONCRETE MIXTURE DESIGN

Description:	Aggregate Type							Asphalt Type
	R.A.P	"D/F " Rock	"F" Rock	Screenings	River Sand			Valero PG 64-22
% by weight	N/A	N/A	N/A	N/A	N/A			N/A

EXTRACTION, GRADATION & LABORATORY TEST RESULTS

	Percent Retained by Weight				**Percent Passing by Weight**		
U.S. Sieve Size	Percent Retained		Job-Mix Tolerance (+/-)	JMF based Grading Bands			
Retained	Individual	JMF Ind.			Cumulative	**JMF**	**Master Gradation Bands**
1/2"	-	N/A	N/A	N/A	100	N/A	N/A
3/8"	3.4	N/A	N/A	N/A	96.6	N/A	N/A
#4	20.8	N/A	N/A	N/A	75.8	N/A	N/A
#8	28.6	N/A	N/A	N/A	47.2	N/A	N/A
#30	15.0	N/A	N/A	N/A	32.2	N/A	N/A
#50	11.0	N/A	N/A	N/A	21.2	N/A	N/A
#200	18.2	N/A	N/A	N/A	3.0	N/A	N/A
Pan	3.0	N/A	N/A	N/A		N/A	N/A
Asphalt (%)	5.6						
HVEEM Stab. %	41						
Max. Dens. (pcf)	152.7						
Lab. Dens. (pcf)	144.4						
Lab. Dens. (%)	94.6						

Remarks:

FIGURE B-3

GEOTEST ENGINEERING, INC.
5600 Bintliff Drive Houston, Texas 77036 Tel. (713) 266-0588

REPORT OF SIEVE ANALYSIS

Project: Scholes International Airport Roadway Pavement Improvements
Galveston, Texas

Job No.: 1140201801

Description: Shell and sand mix
Location: B-1, B-2, B-4, B-6, B-7, B-8, B-9, B-11, B-14

Sieve Size	Cumulative Percent Retained	Required Percent Retained
1 3/4"	0	0
1 1/2"	0	
1"	0.2	
7/8"	0.6	10-35
3/4"	2.5	
1/2"	6.7	
3/8"	10.9	30-50
#4	25.2	45-65
#8	37.8	
#30	56.2	
#40	58.0	70-85
#200	98.5	
Pan	100	

FIGURE B-4a

GEOTEST ENGINEERING, INC.
5600 Bintliff Drive Houston, Texas 77036 Tel. (713) 266-0588

REPORT OF SIEVE ANALYSIS

Project: Scholes International Airport Roadway Pavement Improvements
Galveston, Texas

Job No.: 1140201801

Description: Limestone
Location: B-3, B-10, B-12, B-13

Sieve Size	Cumulative Percent Retained	Required Percent Retained
1 3/4"	0	0
1 1/2"	2.5	
1"	16.1	
7/8"	21.5	10-35
3/4"	29.5	
1/2"	46.1	
3/8"	54.6	30-50
#4	66.5	45-65
#8	70.3	
#30	80.8	
#40	83.8	70-85
#200	97.7	
Pan	100	

FIGURE B-4b